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SOLAR RADIATION AND THE TEMPERATURE IN THE CENTRAL ZONE OF CHILE

(A note received from Señor J. Bustos Navarrete, Director, Observatorio del Salto, Santiago)

El Salto Observatory has just completed a new scientific investigation of the relation between solar radiation and the annual march of temperature in the central zone of Chile.

Two comparative studies are discussed, one on the solar radiation and temperature from 1905 to 1925, the other on solar activity and the temperature from 1889 to 1925.

The conclusions reached in this work are of notable interest. It has been found that the minima of solar activity precede, without exception, minima of temperature. On the other hand, the periods of intense solar activity coincide with the series of relatively warm years * * *.

Moreover, in an earlier work of the Observatorio del Salto, entitled "Solar Radiation and the Rains in the Central Zone of Chile from 1850 to 1925," there has been found a clear relation between those two phenomena.

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V. BJERKNES ON THE THEORY OF SUNSPOTS

(Reprint from Nature, December 18, 1926)

An important contribution to the theory of sun spots and the sun's general circulation is made by Prof. V. Bjerknes in the Astrophysical Journal, September, 1926, under the title "Solar Hydrodynamics." For the details of the theory reference must be made to the paper in question, but a short outline of the main points may be given as follows. On the assumption that a sun spot is a vortex decreasing in intensity from the photosphere downward, their low temperatures are explained from general hydrodynamical and thermodynamical principles.

The results deduced are in accordance with the accepted temperatures of sun spots and the probable velocities of the gases involved in the vortex. A preliminary account of this part of Bjerknes's investigation was given in Nature, March 27, page 463. The well-known properties of sun spots (their usual occurrence in pairs having opposite magnetic polarities, the progression of the spot zones toward the equator during the 11-year cycle, the magnetic-polarity cycle of 22 years, etc.) are explained by making the following suppositions. In each of the sun's hemispheres, northern and southern, there are two zonal vortices having opposite rotations and surrounding the sun approximately as parallels. Wherever part of either vortex rises and cuts the photosphere, a typical bipolar pair of sun spots makes its appearance. As part of a scheme of general circulation, these two zonal vortices revolve around each other in a period of 22 years, being brought alternately near to the surface of the photosphere in latitudes about 40°, progressing equatorward in the course of 11 years, and descending again into the interior near the sun's equator. The scheme of general circulation is one demanding a condition of what is known as stratified circulation.

Renewed investigations are required on the part of observers to determine any possible systematic movements which may be shown by sun spots, faculæ, calcium, and hydrogen flocculi, and prominences. The systematic drifts suggested by the theory are apparently too slow to be observed spectroscopically (cf. Astrophysical Journal, 32, 80, 1910, where St. John compares the mean wave length of K_2 and K_3 near the sun's poles and at the equator for detection of systematic movements).

Professor Bjerknes's paper is also discussed, together with remarks bearing on the question of observed systematic motions of spots and faculæ, by "W. M. H. G." and "H. W. N." in the Observatory for December.

THE BRÜCKNER CYCLE IN THE UNITED STATES

(Author's abstract of a paper read before American Meteorological Society, Philadelphia meeting, December, 1926)

551.58 (048) (73)

By ALFRED J. HENRY

The Brückner cycle of climatic changes, so called from its discoverer, Dr. E. Brückner, postulates that groups of cold and wet, warm and dry years succeed each other in a cycle or period having an average length of 35 years; the length of the period, however, may be only 20 years or as many as 50 years. One half of the period tends to be cool and rainy, while the other half tends to be warm and dry.

The range from low to high temperatures is small, on the average not more than 1° C. (1.8 F.), as shown by five-year averages of the annual mean temperature.

The range in rainfall from wet to dry years, and vice versa, is also small, not to exceed 10 per cent above or below the mean—five-year averages considered.

Brückner reached his results from a consideration of five-year averages of temperature and precipitation as recorded at 321 stations scattered over the globe, most of which, however, were in Europe and North America. He also considered changes in the level of the waters of inland seas, lakes, and rivers, the time of grape harvest in Europe, the advance and retreat of glaciers, etc. From all of these different lines of evidence he concluded that a cycle of 35 years on the average best fitted the evidence.

Since a great many more meteorological stations are now in operation than in 1890, when Brückner published his results. I have recomputed the five-year averages of precipitation for the United States, 1826 to 1920, inclusive, with a view to determining whether or not the oscillations therein agree with those scheduled to occur in a 35-year cycle. In 1923 I computed and published the annual mean temperature for the United States as a single geographic unit for each year of the nineteenth century.

The results of an examination of these data show that both temperature and precipitation oscillate up and down in an irregular manner, but on the average in intervals of 7 to 10 years, counting from maximum to maximum or minimum to minimum. In extreme cases the interval may be as long as 22 years and longer if one considers only the changes of great amplitude; there is, moreover, a lack of uniformity in the distribution of warm and cold, wet and dry years which increases as the area under consideration increases.

Dry years are much more frequent in the United States, and doubtless other countries, than wet ones. Abundant rains were quite general in all parts of the country in the early eighties; since that time, although heavy rains have occurred in parts of the country, as in the Ohio Valley in 1913, the lower Missouri Valley in 1903, 1915, and again in September of the current year, there have been no uniformly wet years in this country.

The known distribution of precipitation the world over teaches us not to expect years of heavy rains concurrently in all parts of the world, but rather that heavy rains may occur in the same year in widely separated parts of the world. The present year seems to have been one of that character.